Remarks

In the Office Action, the Examiner has withdrawn the previous rejection of all of the pending claims, claims 1-29 and 40-50 as amended, under 35 U.S.C. §103(a) over Maes et al., U.S. Patent No. 5,366,651. Claims 1-29 and 40-50 now stand rejected under 35 U.S.C. §103(a) over Wood, U.S. Patent No. 4,455,248, and under 35 U.S.C. §103(a) over Newell, U.S. Patent No. 4,293,441.

Claims 1 and 14 have been amended to clarify that the heat transfer fluid of the present invention has no water added to it, meaning, as described below, that only trace amounts of water as an impurity may be present in the fluid.

As set forth in claims 1-29 and 40-50 as amended, the present application is directed to a non-aqueous heat transfer fluid having reduced toxicity. As set forth in amended Claim 1, the heat transfer fluid comprises ethylene glycol, at least one additional diol which acts as an inhibitor for ethylene glycol poisoning, and at least one corrosion inhibitor additive that is soluble in ethylene glycol and the additional diol. As set forth in claims 4, 5, 13, and 15 - 24, in one embodiment, the additional diol which acts as an inhibitor for ethylene glycol poisoning is propylene glycol. As further set forth in amended claims 27 - 29 and claims 40 - 50, the present application is also directed to methods for reducing the toxicity of existing ethylene glycol based fluids by adding a second diol, such as propylene glycol, which reduces the toxicity of the ethylene glycol based fluid.

As described in the specification at, inter alia, pages 11 and 14-15 and as recited in the amended claims, the heat transfer fluid of the present invention is used as a coolant without the addition of any water. As described in the specification at, inter alia, pages 15-17, the heat transfer fluids of the mixtures described and claimed in the present application exhibit the necessary physical properties, such as, for example, viscosity and

vapor pressure, to function effectively in applications over a broad range of temperatures. The diols in the heat transfer fluid recited in the amended claims serve as the heat transfer medium. Thus, the freezing point of the heat transfer medium is determined by the freezing point of the diols, and the boiling point of the heat transfer medium is determined by the boiling point of the diols.

The heat transfer fluid recited in the amended claims is non-aqueous, meaning that water is not added or intended to be added to the fluid. Any water that is present is an impurity and would be present in very small amounts. Any such water would typically be removed from the fluid in use when the fluid is heated, as in an engine, because the water would be converted to vapor and vented from the system. Because water may only be present in very small amounts as an impurity, any water present in the fluid is insufficient to cause corrosion, and there is no need to included additives to prevent water-caused corrosion of internal surfaces, i.e. no inhibitors requiring water to remain in solution are necessary.

As set forth in the present application at page 11, the only additives present in the heat transfer fluid of the present invention are completely soluble in the diols without the presence of any water. These additives remain dissolved in the fluid regardless of storage or use.

Moreover, as described in the specification at, inter alia, pages 18-21, the non-aqueous heat transfer fluids of the present invention unexpectedly exhibit a reduced oral toxicity than would be predicted based upon the oral toxicity of the major components, such as ethylene glycol or propylene glycol.

As described at page 11 of the specification, one advantage of the heat transfer composition recited in claims 1-29 and 40-50 is that only corrosion inhibitors that are completely soluble in glycols are used in the composition. Accordingly, no water is

necessary in the composition. As described in the specification at pages 7-9, prior art glycol based heat transfer compositions required from 3% to 5% by weight water to dissolve water soluble additives, such as nitrate or metasilicate corrosion inhibitors. Even with 3% to 5% water, the water soluble additives would often precipitate out of solution during storage or during use at elevated temperatures.

Both of the references cited by the Examiner describe fluids which are intended for use by combining the fluid with water. Because water can cause corrosion of various materials in cooling systems, the fluids require corrosion inhibitor additives that are soluble in water. Therefore, as set forth in detail below, the fluids described in Wood and Newell, which are clearly used in aqueous heat transfer systems, necessarily must include sufficient water to maintain the water soluble additives in solution. Even when provided in the concentrated form, the fluids described in Wood and Newell inherently contain sufficient water to maintain the water soluble additives in solution. Accordingly, Wood and Newell do not teach or suggest to one skilled in the art a non-aqueous heat transfer fluid as recited in claims 1-29 and 40-50.

Wood, U.S. Patent No. 4,455,248 describes a glycol-based antifreeze composition which provides multi-metal corrosion protection at elevated temperatures. In use, the antifreeze compositions are diluted with water and used in cooling systems of automobiles having various metal components. See Col. 3, lines 16-26.

The composition described and claimed in Wood contains both sodium metasilicate and a phosphate of potassium. Both of these components required in the composition described by Wood are not readily soluble in glycols, and water must be present to maintain these components in solution. Wood requires 0.05% to 0.030% by weight sodium metasilicate and 1.2% to 4.0% by weight of phosphate. As described by

Wood, these quantities are "exclusive of the water of hydration." See Col. 3, lines 35-38; col. 4, lines 4-6.

Although Wood states that the composition may be provided in a concentrate containing little or no water, as set forth above, the composition necessarily includes sufficient water to maintain the corrosion inhibitors in solution. Therefore, one skilled in the art would understand that the composition described in Wood must contain approximately at least about 2% - 5% water even in the concentrate form. Indeed, Wood states that the composition preferably includes 1% - 5% by weight water.

Sodium metasilicate will not remain dissolved in a non-aqueous glycol-based coolant or heat transfer fluid used under normal operating condition in, for example, the liquid cooling system of an automobile. When high temperatures are encountered, if insufficient water is present, the sodium metasilicate will "drop out", sometimes forming a gel that, over time, can cause clogging of passages in the heat transfer system, such as in the automobile's radiator. Metasilicate "drop out" has been well known in the art as described, for example, in "Properly Maintained Cooling System Prolongs Engine Life", Nevada's Technology Transfer Quarterly, Nevada Milepost, Vol. 7, Number 3, Fall 1997 and the other publications listed in the Supplemental Information Disclosure Statement submitted herewith.

As set forth in the specification and recited in the amended claims, the heat transfer fluid of the present invention includes only additives that are completely soluble in diols, such as ethylene glycol and propylene glycol, which are suitable for use as non-aqueous heat transfer fluids.

Because the composition described by Wood requires the presence of water, Wood cannot render claims 1-29 and 40-50 obvious. Modification of Wood by removing all water to produce a non-aqueous heat transfer fluid such as the heat transfer fluid

recited in the amended claims would result in a fluid that would not function for its intended purpose. Removal of all water from the fluid described in Wood would cause the water soluble corrosion inhibitors present in the fluid to precipitate out of the solution. An obviousness rejection under 35 U.S.C. § 103 is improper if the proposed modification will render the prior art composition unsatisfactory for its intended purpose. MPEP § 2143.01. Accordingly, Applicant respectfully requests that the rejection based upon Wood be withdrawn.

Newell, U.S. Patent No. 4,293,441, is directed to compositions containing fluoroaliphatic radical-containing phosphonic acid for use as a heat transfer medium in systems containing aluminum. Newell is concerned with the use of certain phosphonic acids as corrosion inhibitors in heat transfer fluids used, for example, in internal combustion engines containing aluminum components.

In the specification, Newell provides examples of the use of the corrosion inhibitor in aqueous solutions containing ethylene glycol. See, e.g., Col. 10, lines 13-55. Newell claims the use of the phosphonic acid corrosion inhibitor in liquid compositions comprising ethylene glycol or propylene glycol, but does not claim mixtures of the two. Newell also claims the use of the phosphonic acid corrosion inhibitor in aqueous solutions of ethylene glycol.

Newell makes a passing reference to possible use of mixtures of ethylene glycol and propylene glycol; Col. 1, lines 41-52. However, Newell does not describe, teach or claim any compositions containing mixtures of ethylene glycol or propylene glycol. Moreover, Newell does not teach or suggest any compositions having mixtures of ethylene glycol and propylene glycol in the ranges set forth in the claims. Accordingly, Newell does not teach or suggest the compositions of claims 1-29 as amended, and the rejection of these claims based on Newell should be withdrawn for at least this reason.

The rejection under 35 U.S.C. § 103 based on Newell should be withdrawn for the additional reason that the fluid described in Newell requires water to prevent precipitation of the fluroaliphaticphosphonic acid inhibitor. Although Newell states that little or no water needs to be added to the fluid to use the fluid at elevated temperatures (col. 5, lines 63-66), Newell admits that some water is required, and that an additional surfactant may be necessary to maintain the additive in its dissolved state:

> While the phosphonic acid salts are sufficiently soluble in aqueous solutions, the free acid has relatively low solubility. In concentrated solutions and in solutions at a pH of less than 7, it will generally be desirable to include a non-ionic surfactant, particularly a fluroaliphatic non-ionic surfactant, to stabilize the solution. Generally, about equal weighs of surfactant and fluroaliphatic phosphonic acid or salt may be used.

Col. 6, lines 9-16.

Additives such as those described in Newell, which have low solubility in diols such as ethylene glycol and propylene glycol, will not remain in solution without the presence of some amount of water sufficient to maintain the additive in solution.

Newell specifically addresses aluminum corrosion. His entire abstract reads:

> A liquid composition useful for minimizing corrosion of aluminum surfaces comprising ethylene glycol or propylene glycol and fluoroaliphaticsulfonamidophosphonic acid or the salt thereof.

The heat transfer fluids of the present invention, which are entirely non-aqueous, require no additives to prevent, specifically, the corrosion of aluminum. The additive described in Newell to prevent corrosion of aluminum must have sufficient water to maintain the additive in solution, and Newell therefore does not describe a non-aqueous heat transfer fluid such as the heat transfer fluid recited in the amended claims.

A reference must be considered in its entirety when used as a basis for a rejection under 35 U.S.C § 103. "[I]t is impermissible within the framework of section 103 to pick and choose from any one reference only so much of it as will support a given position, to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art." In re Wesslau, 353 F.2d 238, 147 U.S.P.Q. 391 (CCPA 1965). When Newell is considered in its entirety, it clearly describes a fluid which requires some water even in its concentrated form to maintain water soluble additives in solution.

Modification of Newell by removing all water to produce a non-aqueous heat transfer fluid such as the heat transfer fluid recited in the amended claims would result in a fluid that would not function for its intended purpose. Removal of all water from the fluid described in Newell would cause the water soluble fluroaliphaticphosphonic acid corrosion inhibitor present in the fluid to precipitate out of the solution. An obviousness rejection under 35 U.S.C. § 103 is improper if the proposed modification will render the prior art composition unsatisfactory for its intended purpose. MPEP § 2143.01. Accordingly, Applicant respectfully requests that the rejection based upon Newell be withdrawn.

In view of the foregoing remarks, this application should now be in condition for allowance. A notice to this effect is respectfully requested. If the Examiner believes after considering these remarks, that the application is not in condition for allowance, the Examiner is requested to call the Applicant's attorney at the telephone number listed below.

Because the reasons above are sufficient to traverse the rejection, Applicants have not explored, nor do they now present, other possible reasons for traversing such

rejections. Nonetheless, Applicants expressly reserve the right to do so, if appropriate, in response to any future Office Action.

A petition for a three month extension of time and associated fee extending the time to respond to Office Action from January 24, 2004 to April 24, 2004 has been filed herewith. No additional fee is believed to be required. However, if an additional fee is required or otherwise necessary to cover any deficiency in fees paid, authorization is hereby given to charge our Deposit Account No. 50-1402.

Respectfully submitted,

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